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ABSTRACT

This guide is one in the "Exploration" series of curriculum guides intended to assist junior high and middle school industrial educators in helping their students explore diverse industrial situations and technologies used in industry. The lessons provided deal with exploring technology and the future (futurists, forecasting techniques, technology assessment, and example technologies for the near future) and forecasting the city of the future. The guide includes the rationale behind its development, hints to the teacher, lesson plans, student handout masters, teacher aids, a unit examination, and a list of references. The lesson plans include cross-referenced lists of objectives, lesson content, and learning activities. (MN)

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EXPLORING TECHNOLOGY AND THE FUTURE

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PACKET INCLUDES:

Rationale
Hints to the Teacher
Lesson Plans
Student Handout Masters
Teacher Aides
Unit Examination
References



CE 050 296

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INTRODUCTION

"Exploring Technology and the Future" is one of a series of curriculum materials developed for junior high and middle school industrial educators. Listed below are the titles of the units in the series.

Communication

- Using the Language of Industry
- Exploring Computer Technology
- Exploring Photography
- Exploring Graphic Communication
- Exploring Electronic Communication

Energy Utilization

- Exploring Solar Energy
- Using Alternate Energy Sources
- Conserving Energy Sources
- Exploring Electricity/Electronics
- Exploring Mechanical and Fluid Systems

Impact of Industry and Technology

- Recycling Materials
- Limiting Pollution
- Exploring Careers in Industry
and Technology
- Exploring Technology and the Future

Production

- Exploring Materials and Processes
- Exploring Construction Technology
- Research and Development
- Exploring Manufactured Systems
- Servicing Products

Transportation

- Exploring Land Transportation
Systems
- Exploring Aviation Technology
- Exploring Water Transportation
Systems
- Exploring Space Transportation
Systems
- Exploring Materials Handling
Systems

With the Exploration Series, industrial educators can lead their 7th and 8th grade students in exploring many industrial situations and technologies used in industry. In addition, this series can serve as a resource for teachers orienting 9th and 10th grade students to industrial technologies in communication, production, energy utilization and transportation. Each unit in the series includes a rationale, hints to the teacher, lesson plans, student handouts, teacher aids, a unit examination, and a list of references.

"Exploring Technology and the Future" and other units in the series are available on a cost recovery basis through the Curriculum Publications Clearinghouse, Western Illinois University, Horrabin Hall 46, Macomb, IL 61455.

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EXPLORING TECHNOLOGY AND THE FUTURE

Rationale

Throughout history, technology has had a very profound impact on the way we live and work. Technology will continue to shape the way we live in the future. An introduction to the techniques used by futurists to forecast the future can help students anticipate the opportunities and challenges that lie ahead. An awareness of future possibilities can help students make more informed decisions about their own future.

During this unit, students will utilize their imaginations and a variety of forecasting techniques to describe what a city of the future might look like. In addition, students will be exposed to the concept of technology assessments. Students will also have an opportunity to develop logical reasoning and creative skills.

EXPLORING TECHNOLOGY AND THE FUTURE

Hints to the Teacher

1. To ensure student success, this unit should be implemented toward the end of your students' technology education experience. Implementing this unit at the end will enable your students to develop the knowledge base they need to forecast the future. Prior to implementing the lesson, your students need to be exposed to topics like ocean thermal energy conversion, modular construction, robotics, air cushion vehicles, geothermal energy, solar energy, monorails, networking, personal rapid transit systems, and space transportation systems.
2. During this unit, your students will be building a model illustrating what they think the city of the future might look like. Prior to implementing this lesson, you will need to collect a variety of easy-to-work materials. This unit includes a list of suggested materials. You may want to establish a box early in the school year for collecting unique pieces of scrap and various materials that can be used to construct an architectural model.
3. This unit represents an excellent opportunity to promote technology education in your school community. Invite parents, administrators, reporters, and teachers to your students' city of the future presentations. Video tape your students presentations to show at open houses and during student recruitment activities. Display your students' city of the future models in a location where other members of the school community can see the results of your students' forecasting activities.
4. Your school library can be a very valuable source of information for forecasting the future. To save time prior to implementing this lesson, you may want to visit your school library and identify reference materials that can help your students with their forecasting activity.

EXPLORING INDUSTRY AND ITS TECHNOLOGIES

Unit: Exploring Technology and the Future

Lesson 1: Exploring Technology and the Future

Objectives

- A. Following a discussion, the students will be able to:
- describe the characteristics of a futurist.
 - describe the five basic techniques used to study and forecast the future.
 - identify a definition for technology assessment.

Lesson Content

- A. Exploring technology and the future
1. Futurists
 - a. people who study and forecast the future.
 - b. do not try to predict the future.
 - c. suggest things that might happen so people can plan for the future.
 2. Forecasting techniques
 - a. trend projections
 - b. scenarios
 - c. consulting others
 - d. models
 - e. simulations
 3. Technology assessment
 - a. is a process for evaluating new forms of technology
 - b. used to identify positive and negative aspects of a new technology
 4. Example technologies for the near future.
 - a. electric cars
 - b. hydroponic farms
 - c. ocean thermal energy conversion
 - d. personal robots
 - e. computer integrated manufacturing

Learning Activities

- A. Teacher Guided Discussion
1. Ask students what it would be like to live in the future. Discuss the role technology will have in shaping the future.
 2. Using OT#1-1, discuss the roles of the futurists in studying and forecasting the future.
 3. Using OT #1-2, discuss the techniques used by futurists to study and forecast the future. Provide examples for each forecasting technique.
 4. Using OT #1-3, discuss the concept of technology assessments.

Ref.

B. Following a demonstration in a lab activity, students will be able to:

- design and build a model showing what a city of the future might look like.
- develop a variety of scenarios describing how a city of the future might function.
- make a presentation describing their city of the future.

B. Forecasting the city of the future

1. Analyzing the problem
2. Selecting a site.
3. Developing scenarios.
4. Identifying major components.
5. Building a model for each component.
6. Identifying relationships between components.
7. Connecting the components.
8. Presenting what the city of the future might look like.

B. Learning Activities

1. Provide each student HO #1-1 and explain how to perform the learning activity.
2. Explain how to use the tools and materials needed to build their models. Stress important safety considerations.
3. Divide your class into groups of about four students. Assign each group a work station.
4. Have students begin developing their cities of the future.
5. Circulate around the room and provide individual instruction as needed.
6. Encourage and recognize teamwork and creativity.
7. When students have completed their models, have each team present their city of the future to the rest of the class.
8. Evaluate each team's presentation, scenarios, and model.

EXPLORING TECHNOLOGY AND THE FUTURE

Preparation Hints:

1. Review the materials provided, duplicate HO #1-1, and prepare the transparencies needed to present this lesson.
2. During the lab activity, your students will be making architectural models for cities of the future (see Figure 1-1). Prior to implementing this lesson, you will need to collect a variety of easy-to-work materials for making architectural models. You may want to include things like construction paper, cardboard, aluminum foil, clear plastic wrap, paper or styrofoam cups, paper or styrofoam plates, straws, wire, plastic pipe, rubber hose, foam core, glue, rubber cement, tape, and magic markers. In addition, your students will need x-acto knives, scissors, hacksaws, and hot glue guns.
3. Consider inviting administrators, parents, guidance counselors, and teachers to your students' city of the future presentations. For best results, have your students make and present the invitations.

Content Presentation Hints:

1. During your discussion of futurists, stress the fact that they do not try to predict the future. Rather, emphasize their efforts to describe what might happen in the future if people allow current trends to continue. In addition, point out the fact that futurists study and describe the future so people can plan for the challenges that may lie ahead.
2. When discussing trend draw a variety of graphs on the chalkboard. Ask students to identify patterns and make projections. Among your examples, include graphs that illustrate upward trends, downward trends, no trend at all, and trends that repeat in cycles (see Figure 1-2).
3. During your discussion on scenarios, ask students to help you complete a scenario on a given topic. Begin your scenario by describing a new innovation in the future. For example, "It is the year 2000. A new long lasting battery has finally been introduced after years of research and development. The new battery can be used to power . . . " You may want to encourage students to develop two scenarios, one positive, and one negative.

4. While discussing models, ask students to help you to develop a model for the factory of the future. Use scraps of wood to represent production, receiving, shipping and computer areas. Ask students how to arrange the pieces of wood to illustrate their concept of a factory of the future. Use a magic marker to show how the various areas are connected, and to illustrate how information and material flows through the facility.
5. During your technology assessment discussion, ask students to list examples of technologies that should have been assessed more carefully. For example, students could identify nuclear energy because of its high cost, hazardous waste, and potential for accidents.
6. Consider showing a film or video tape on forecasting the future.

Learning Activities:

1. Consider taking your students to the library for one class period. While in the library, your students could collect a variety of ideas for their cities of the future from reference materials, periodicals and books. In addition, they could also gather information about famous futurists and forecasting techniques.
2. Consider conducting a Delphi Study during the first five minutes of each class period for about four days. On the first day, ask students what it would be like to live in a city of the future. Have students write their ideas on 3 x 5 cards. Collect the ideas and list them on a questionnaire for the following day. The questionnaire should allow students to accept ideas, reject ideas, or modify ideas. On the second day, distribute the questionnaire and have students respond to each idea. When students are finished, collect the questionnaires and use the students' responses to create a new questionnaire for the following day. On the third day, ask students to respond to the revised questionnaire. On the fourth day, you should be able to report the results of the Delphi Study. Consider publishing the results in the school or community newspaper.
3. Have students perform a technology assessment by developing a futures wheel for their city of the future. The first step in developing a futures wheel is to draw a 2 inch circle in the center of a large sheet of paper. Write the topic for the futures wheel in the

center of the circle. In this case, the topic is the location for their city of the future. The next step is to identify the immediate negative and positive impacts of living in the new location. Have students write each impact in its own circle. Draw a line to connect each impact circle with the topic circle. The next step is to identify the secondary impacts for each immediate impact. Write each secondary impact in its own circle and connect it to the immediate impact circle. Continue this process until you have three generations of impacts surrounding your topic circle. Refer to Figure 1-3 for an example futures wheel.

4. When your students have finished their models, consider displaying their cities of the future in a location where the rest of the school community can see the results of their forecasting activities.
5. If your students have difficulty identifying a location for their city of the future, suggest the following options.
 - * on the ocean
 - * under water
 - * in space
 - * on the moon
 - * above ground

Futurists:

- people who study and forecast the future.
- do not try to predict the future.
- suggest things that might happen so people can plan for the future.

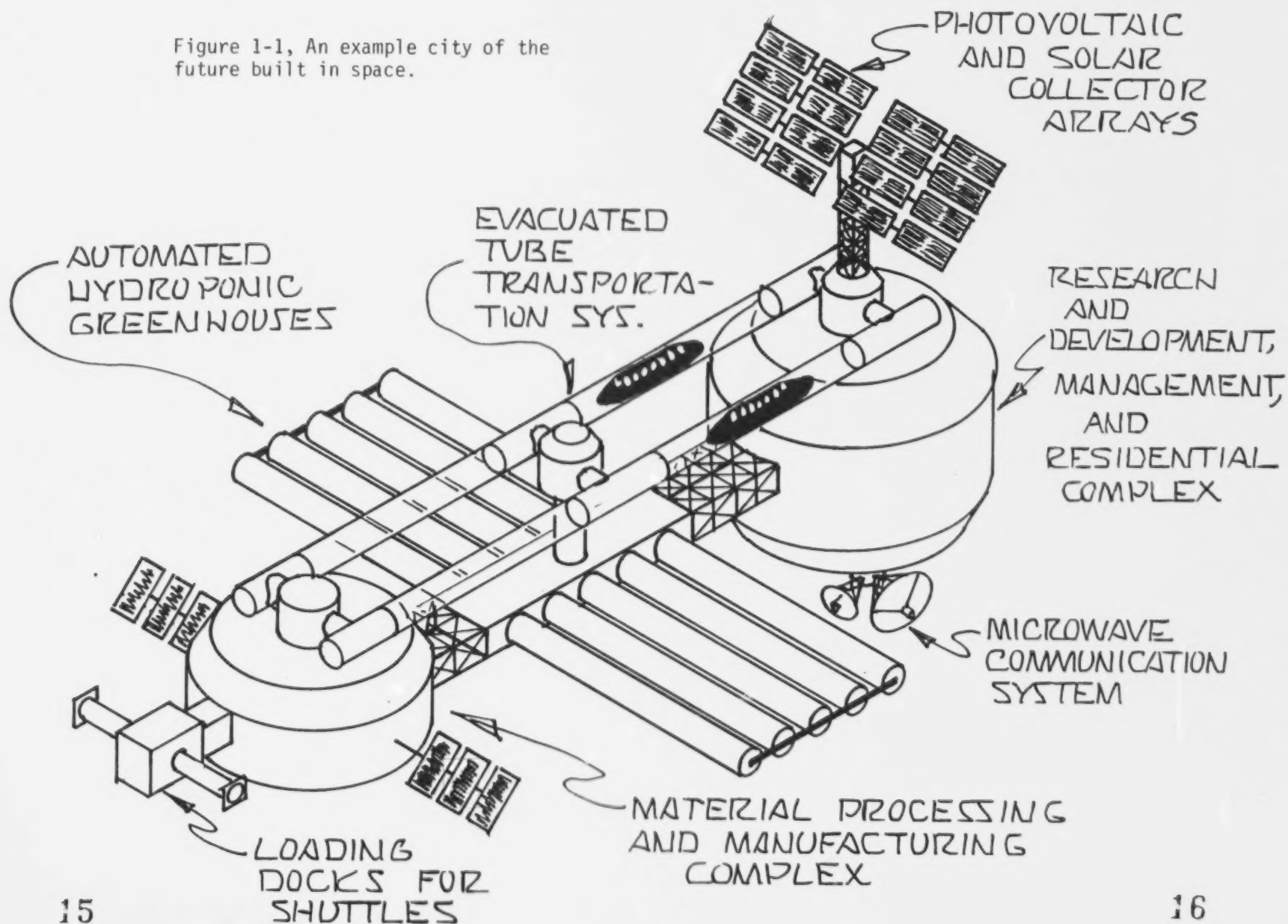
Forecasting techniques:

- trend projections
- consulting others
- models
- simulations

Technology Assessment:

- is a process for evaluating new forms of technology.
- used to identify positive and negative aspects of a new

Figure 1-1, An example city of the future built in space.



----- PROJECTIONS

Figure 1-2, Example Trend Projections

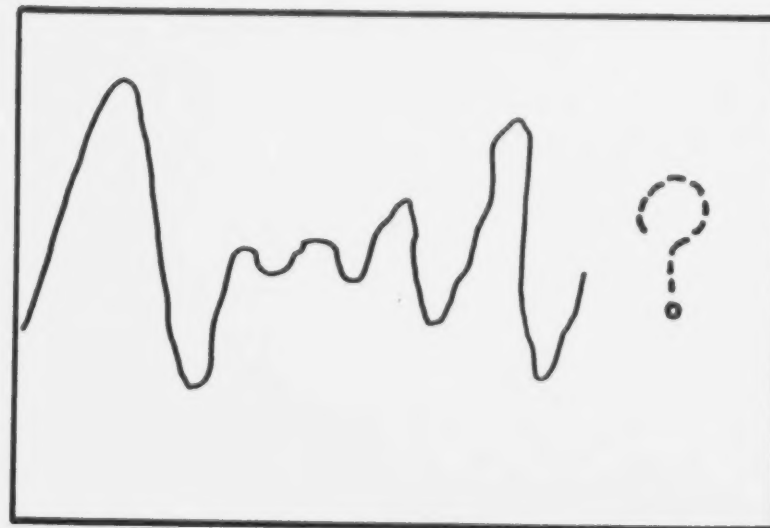
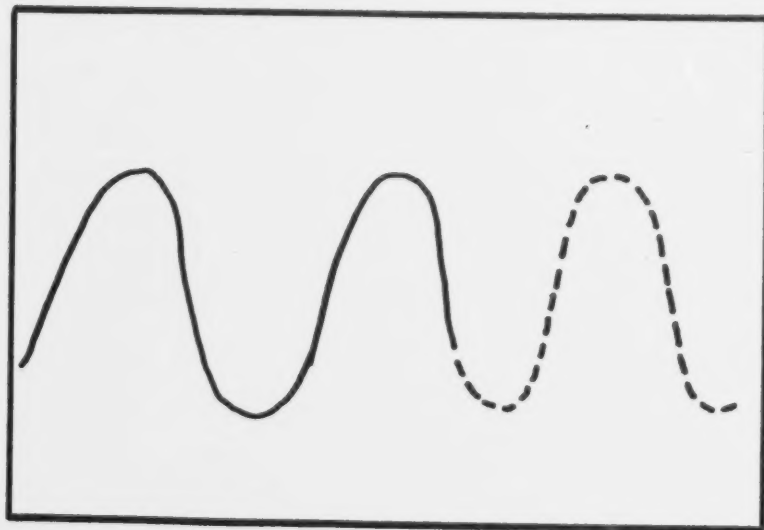
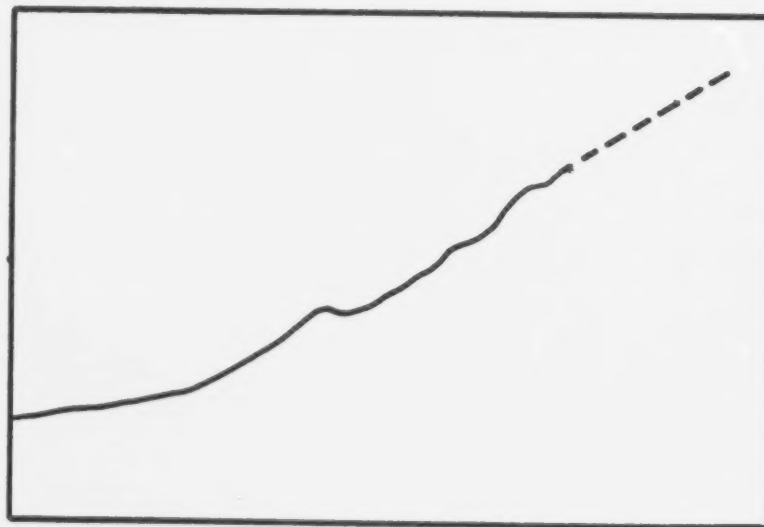
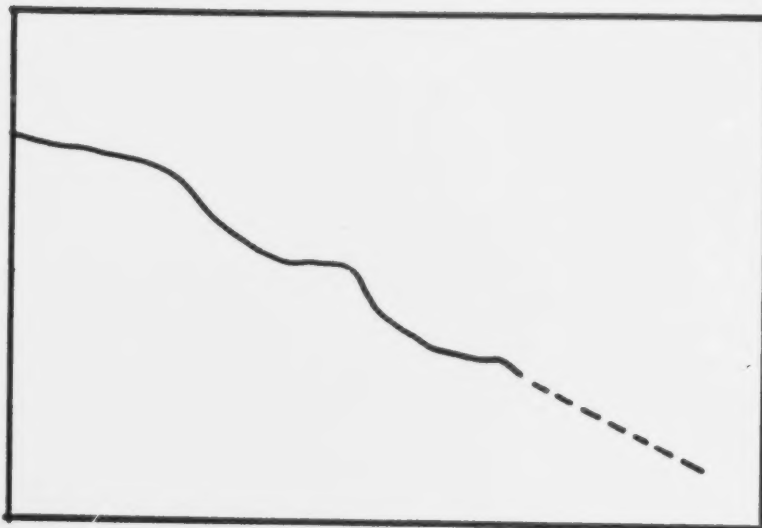
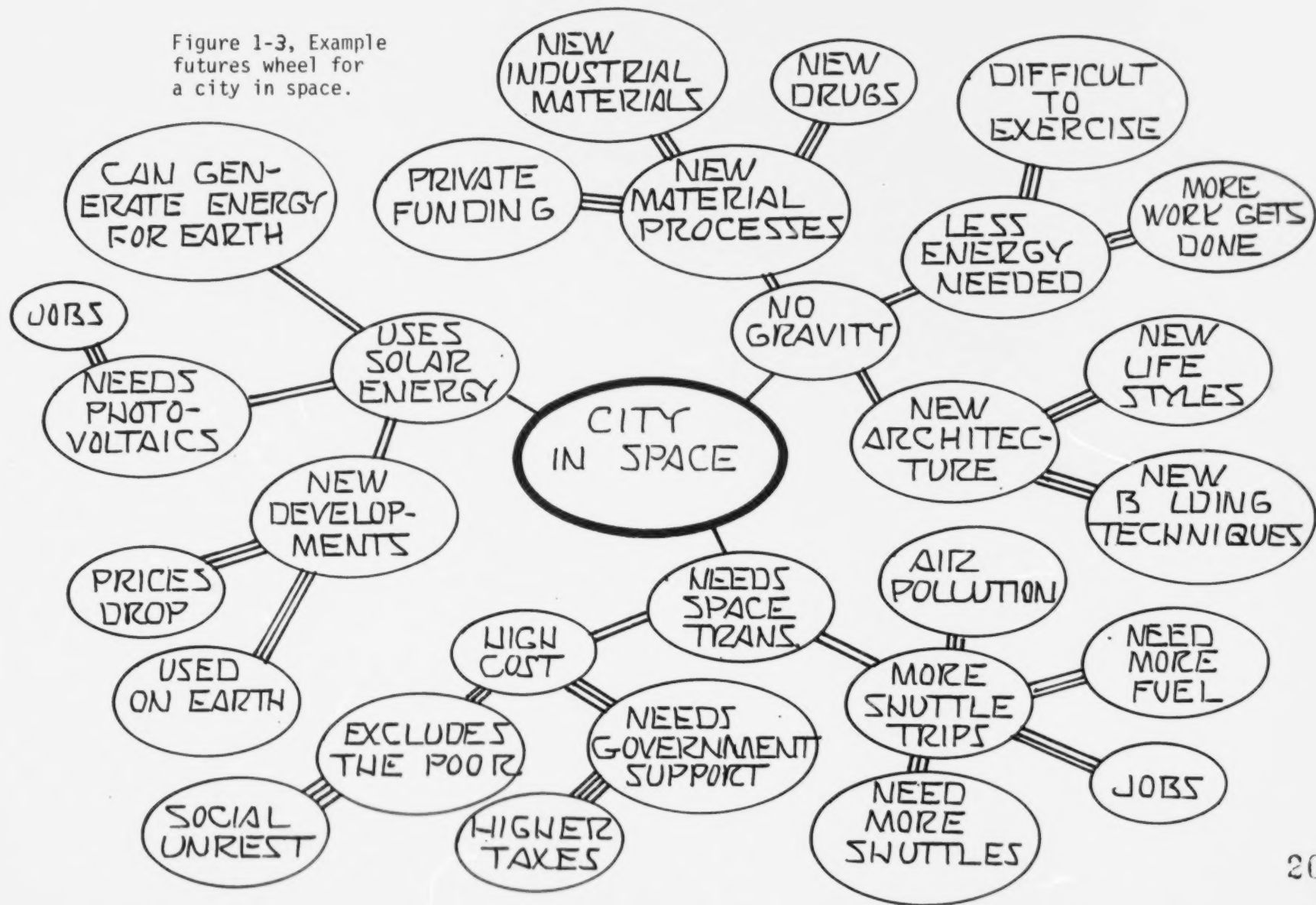


Figure 1-3, Example
futures wheel for
a city in space.



EXPLORING TECHNOLOGY AND THE FUTURE

Discussion:

Have you ever imagined what it would be like to live in the future? Winston Churchill once said "the farther we can look behind, the greater we can see ahead." He felt a good way to look into the future is to examine our past.

The inventions of the last hundred years have given us automobiles, telephones, televisions, personal computers, airplanes, and much more. It wasn't that long ago high tech meant indoor plumbing, a Model T Ford, and an electric refrigerator. Today, having the latest technology means cordless phones, microwave ovens, video tape recorders, cable television, personal computers, compact disk players, and electronically fuel injected automobiles. Our homes are full of labor-saving and entertainment devices. All these inventions have had a significant impact on the way we live and work.

How will technology shape our lives in the future? This is a question for a futurist. Futurists are people who study and forecast the future. Futurists do not try to predict the future. They try to suggest things that might happen in the future. Knowing what might happen can help people to plan for the future. For example, if we know we will run out of oil someday, we can begin to conserve energy and develop new energy sources.

Futurists use a variety of techniques to study and forecast what might happen in the future. These techniques include:

- * trend projections
- * scenarios
- * consulting others
- * models
- * simulations

To use trend projections, futurists study past events and look for patterns. For example, suppose you are interested in forecasting the future of home computing. The first step is to study the sales report from the top five microcomputer manufacturers for the past five years. During the investigation, you notice a pattern. Microcomputer sales have increased every year and microcomputer prices

have dropped every year. Every time sales go up, prices go down. By projecting this pattern into the near future, you could safely say microcomputer sales will continue to increase as long as prices continue to drop. Basically, trend analysis/projection is using past trends to forecast the future trends.

Scenarios are imaginative stories used to describe what could happen in the future. Before making an important decision, many people ask themselves, "what is the worst thing that can happen?" The answer to this question is a scenario. Scenarios are often used to describe the possibilities that need to be considered when making a decision. An important consideration when using scenarios is to imagine a variety of possibilities, good and bad.

As the old saying goes, "two heads are better than one." Futurists often consult experts when forecasting the future. Depending on the study, these experts could be scientists, technologists, or other futurists. Unfortunately, experts rarely agree, especially when it comes to the future. Therefore, futurists often use the Delphi Technique to gather and process opinions from experts. The goal is to get all the experts to agree on one set of idea. The first step is to interview experts and collect ideas about a topic. The second step is to share the collection of ideas with all the experts. Each expert is asked to read and revise the ideas. The revised ideas are collected and shared with all the experts again. The collecting, sharing, and revising cycle continues until the experts agree on one set of ideas.

Models can be used to describe the future the same way they are used to describe a design for a new building or product. Models can be graphic or physical representations of the future. The first step in creating a model is to identify its major parts. For example, a model for the factory of the future might include a production area, a receiving area, a shipping area, and a computer area. Once the parts have been identified, the relationship between the parts can be established. Models allow futurists to experiment with their ideas about the future. They can change a part of the model and study how it might effect the other parts. The act of making a model helps the futurist discover and understand what the future may hold.

Simulations use role playing to explore and describe what can happen in the future. For example, to learn how astronauts would behave in a weightless environment, NASA asked them to participate in a variety of simulations.

During one simulation, the astronauts were asked to perform tasks in their space suits while underwater in a swimming pool. The swimming pool provided an environment similar to weightlessness for role playing tasks that will need to be performed in space. Computers are often used for simulations because they can process a lot of information. Like models, futurists can use computer simulations to conduct experiments. Industry often uses computer simulations to determine how given forces will effect a design.

The techniques used for future studies can also be used for technology assessments. Technology assessment is a process for evaluating new forms of technology. The goal of technology assessments are to identify the positive and negative impacts new technologies might have on society and the environment. For example, assessments of robotic technology uncovered its potential to replace people on assembly lines. At first, this was thought to be a negative impact. However, assessments have also uncovered the fact that robots are primarily used to perform tasks that are dull, dirty, or dangerous. In addition, evaluators felt appropriate use of industrial robots can free people for more important work and secure many jobs by making companies more productive. It is very important to weigh the positive and negative aspects of a new technology before it is widely used.

Futurists are people who study and forecast the future. They try to suggest things that might happen in the future so people can make informed decisions and plan for the future. Futurists use techniques like trend/projections, scenarios, consulting others, models, and simulations to describe the future. Future studies can play an important role in technology assessment. Technology assessment activities identify the positive and negative aspects of new technology before it is used.

Learning Activity:

Being a group of world renowned futurists, your class has been asked to describe the city of the future. According to trend projections, the population of the earth will exceed the amount of inhabitable (livable) land available to feed and house the population. People might need to build their cities in new locations.

Your job will be to build a model showing what a city of the future might look like. When you have finished your model, your team will present scenarios describing how your city of the future might work.

Directions:

1. Begin your forecasting activity by selecting a site for your city of the future. List and discuss the options, then vote on the site you would like to use for your city of the future. Identify the site your team has selected in the space provided.

2. Discuss the following questions. Try to develop a scenario for each question. Record your ideas in the spaces provided. Do not be surprised if your ideas change as you progress through the activity. You may want to use a pencil so you can change your scenarios easily.

Where will people live in your city of the future?

Where will people work in your city of the future?

Where will people play in your city of the future?

Where will people learn in your city of the future?

How will people transport goods and themselves from one place to another in your city of the future?

How will people communicate to each other in your city of the future?

How will people process waste (garbage and sewage) in your city of the future?

How will people produce food in your city of the future?

How will people generate energy in your city of the future?

How will people produce and purchase goods in your city of the future?

3. The next step is to identify the major components (parts) of your city of the future. For example, your city will need to include places to live, work, and play. In addition, your city will need energy, communication, and transportation and production systems. List the major parts of your city in the spaces below.

Components

4. Using the materials provided, build a model for each major part of your city. Continue to discuss your city and refine your scenarios. Do not be afraid to use your imagination.
5. When the parts of your city are finished, discuss how they need to be connected. For example, you may need to transport people from a residential area to an industrial area. Or, you may need to establish a communication link between an energy generator and an agricultural area. Use the materials provided to connect each part of your city. Experiment with several configurations before you fasten the part together permanently. Remember to refine your scenarios as you develop your model.
6. When your model is finished, plan your presentation. Make sure your scenarios are complete. You may need to write a final draft on a separate sheet of paper if you have made a lot of changes. Divide your presentation into parts so each member can participate. Each team member could focus their presentation on one section of the city. Your presentation should describe where people will live, work, play and learn. In addition, your presentation should describe the energy, communication, transportation, and production systems at work in your city. Good luck.

EXPLORING INDUSTRY AND ITS TECHNOLOGIES

Unit: Exploring Technology and the Future

Lesson 2: Evaluation

Objectives

- A. Following a review, the students will be able to complete given concept statements regarding technology and the future with a minimum of 70% accuracy.

Lesson Content

- A. Review
1. Futurists
 2. Forecasting techniques
 3. Technology assessment

Learning Activities

- A. Teacher Guided Review
1. Review the major concepts explored in this unit.
 2. Provide the students with an opportunity to ask questions before taking the test.
 3. Provide the students with HO #2-1. Make sure each student has a pen or pencil.
 4. Explain the directions for the test.
 5. Have the students read the test and answer the questions provided.
 6. Collect the test and grade your students' performance.
 7. Provide the students with feedback regarding their performance as soon as possible.

Ref.

EXPLORING TECHNOLOGY AND THE FUTURE

Unit Test

DIRECTIONS: Read each statement carefully. In the blank provided, write the letter of the answer option which best completes or answers the question.

- _____ 1. Futurists are people who _____.
A. predict what will happen in the future.
B. suggest things that might happen in the future.
C. live in the future.
D. all of the above
- _____ 2. Imaginative stories that describe what could happen in the future are called _____.
A. fabrications
B. projections
C. scenarios
D. predictions
- _____ 3. Which of the following forecasting techniques uses role playing to describe the future.
A. simulations
B. scenarios
C. analogies
D. Delphi Studies
- _____ 4. Technology assessment is a process for _____.
A. gathering and processing the opinions of experts.
B. conducting simulations.
C. evaluation new forms of technology.
D. designing and building models.
- _____ 5. The goal of a technology assessment is to _____.
A. identify positive and negative impacts of a new technology.
B. develop new forms of technology.
C. stop the development of new technology
D. help government control the development of new technology.

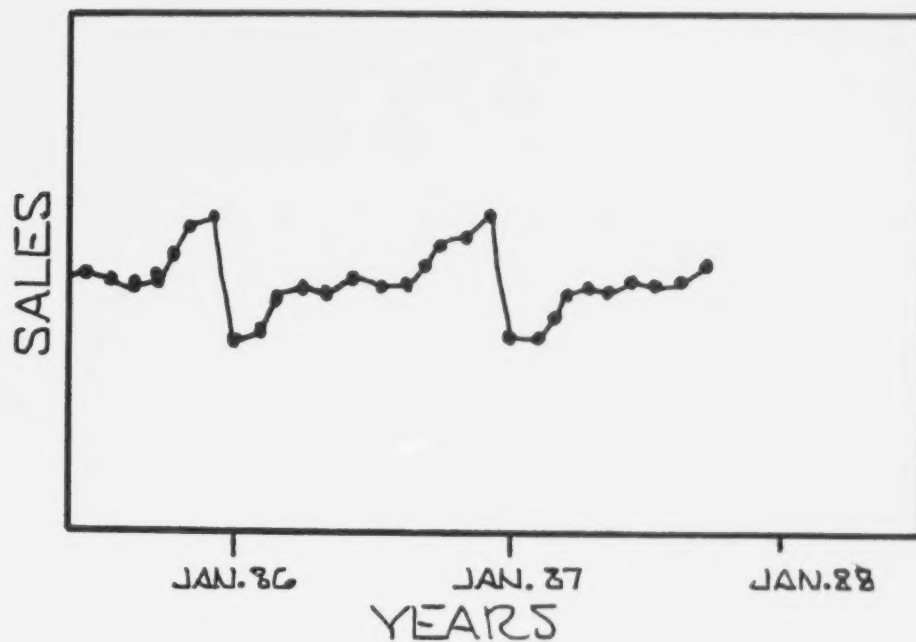
- _____ 6. Which of the following techniques would be best for forecasting product sales?
- A. scenarios
 - B. consulting others
 - C. simulations
 - D. trend analysis/projections
- _____ 7. Using an aircraft carrier to experience what it would be like to live on a floating city is an example of a _____.
- A. scenario
 - B. simulation
 - C. technology assessment
 - D. model
- _____ 8. The first step in developing a model for forecasting the future is to _____.
- A. identify the relationship between parts.
 - B. build the model.
 - C. identify the major parts.
 - D. present the model.

Directions: Write a short scenario to complete the following paragraph.

People once had to place all their phone calls through an operator. The development of the mechanical telephone switch enabled people to dial their own phone numbers. Today, we can dial a phone number by pushing one button on a programmable phone. In the future, we will be able to dial the phone by _____.

9. _____

Directions: Using trend projections, project what the sales curve might look like for the next three months. Illustrate your projection by drawing a dotted line on the graph below.



EXPLORING TECHNOLOGY AND THE FUTURE

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